Small Business Innovation Research/Small Business Tech Transfer

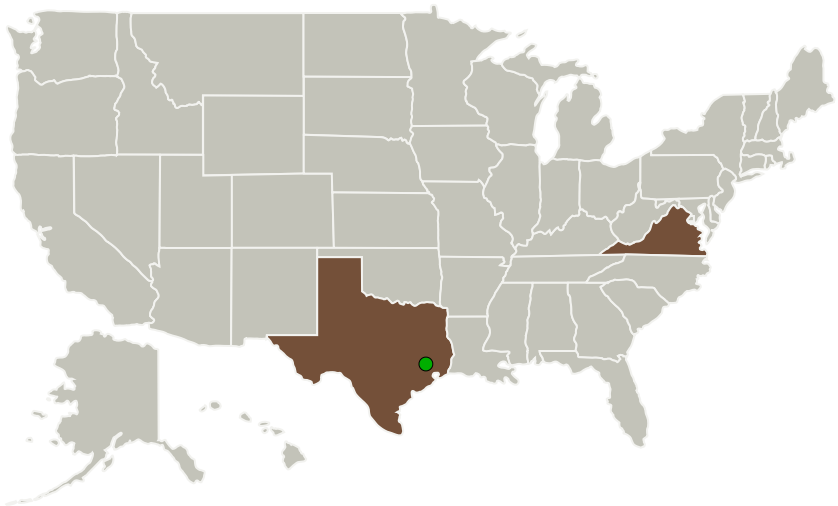
Lightweight, Low Permeability, Cryogenic Thoraeus RubberTM Inflatables, Phase I

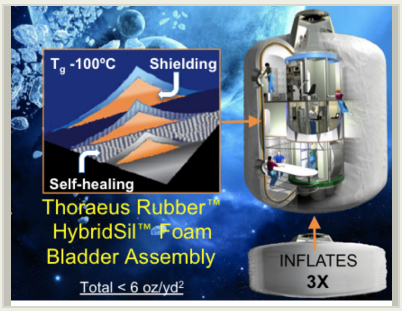
Completed Technology Project (2013 - 2013)

Project Introduction

NanoSonic has developed a candidate state-of-the-art inflatable as a novel bladder material for life critical, space habitats that maintains low air permeability (< 0.0017 cc/100in2/day/atm) upon the triple fold cold flex test conducted at -50 ?C. The multifunctional Thoraeus Rubber™ (TR) films are comprised of a low glass transition temperature (Tg), - 100 ?C, copolymer matrix resin modified with alternating layers of ultra-thin, uniform layers of proprietary nanoparticles for radiation resistance. NanoSonic's unique molecular level deposition technique yields pinhole-free nanocomposites with that maintain radiation and EMI shielding (up to -100 dB) upon severe (50 % elongation) and repeated mechanical strain, a property that few if any inflatable exhibit. NanoSonic proposes to produce a triply redundant bladder assembly comprised of several layers of TR™ films bonded with our low areal density self-healing foam, for a total areal density of less than 6 oz/yd2. To substantiate long-term use in space, the down-selected, puncture resistant assemblies shall be exposed to gamma, electron, and heavy ions at the NASA Space Radiation Laboratory (NSRL) at Brookhaven National Laboratory via our partner, Colorado State University (CSU). Low air permeability and flammability resistance would be verified after simulated Galactic Cosmic Radiation (GCR) exposure and cryogenic flex testing. NanoSonic has teamed with seaming and space systems experts who will conduct leak and adhesion testing, and assist with habitat construction. In support of NASA's goals for a robust space exploration program, it is anticipated that NanoSonic's lightweight, low permeable bladders shall enable space inflatable modules that exhibit long-term, 5 year, radiation resistance upon inflation, minimize launch mass, repair/maintenance, size and costs.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Nanosonic, Inc.	Lead Organization	Industry	Pembroke, Virginia
Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations	
Texas	Virginia

Project Transitions

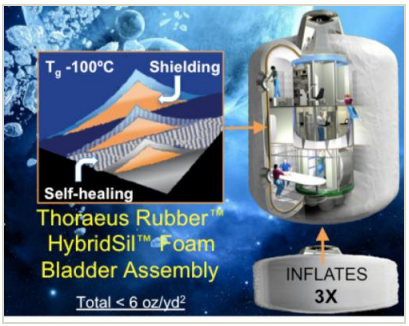
May 2013: Project Start

November 2013: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138254)*

Images



Project Image
Lightweight, Low Permeability, Cryogenic Thoraeus RubberTM Inflatables
(https://techport.nasa.gov/image/133836)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Nanosonic, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Jennifer Lalli

Co-Investigator:
Jennifer Lalli

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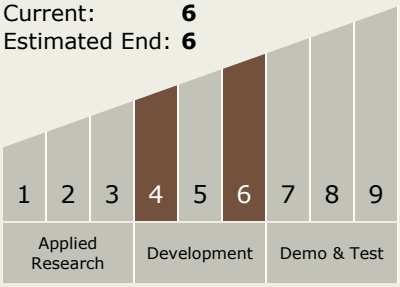
Completed Technology Project (2013 - 2013)

Technology Maturity (TRL)

Start: **4**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.1 Environmental Control & Life Support Systems (ECLSS) and Habitation Systems
    - TX06.1.4 Habitation Systems

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System